* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to an electric shaver, especially a both-way formula electric shaver equipped with two or more cutting edges.
[0002]
[Description of the Prior Art] Conventionally, as this kind of an electric shaver, what has two or more cutting edges as shown in drawing 16 is known. That is, this thing is two network cutting edges 1 and 2 which are head cutting edges. Slit cutting edge 3 in the meantime It is the trimer cutting edge 4 to the side face of a body. It has. Network cutting edges 1 and 2 Slit cutting edge 3 Outside cutting-edge 1b which shaves a mustache and has many blade holes respectively, and 2b Inner cutting edges 1a and 2a which are inscribed in an outside cutting edge and reciprocate It has. They are the network cutting edges 1 and 2 in more detail. Slit cutting edge 3 It is in both sides, a mustache is shaved finely, and the blade hole is making the shape of a small hole. On the other hand, it is the slit cutting edge 3. Network cutting edges 1 and 2 Shaving coarsely the long mustache which it shaved and left, the blade hole is making the shape of a slit. Moreover, trimer cutting edge 4 Sideburns etc. are cut and it consists of stationary-knife 4b of a pectinate form, and movable cutting-edge 4a which reciprocates in slide contact with it.
[0003] these network cutting edges 1 and 2, the slit cutting edge 3, and trimer cutting edge 4 Transfer member E it connects -- having -- one motor 6 it drives -- having -- **** -- the time of shaving -- network cutting edges 1 and 2 Slit cutting edge 3 the time of the trimer who moves to coincidence and cuts sideburns etc. -- trimer cutting edge 4 not only -- network cutting edges 1 and 2 Slit cutting edge 3 It moves to coincidence.
[0004]
[Problem(s) to be Solved by the Invention] There were the following faults in the above conventional electric shavers. That is, at the time of shaving, it is the slit cutting edge 3. After shortening a long mustache, they are the network cutting edges 1 and 2. Since ****** of finishing is performed, it shaves, and it is the slit cutting edge 3 in the beginning. Although it is effective In order to end processing of a long mustache mostly from the middle and to go into the phase of finishing, it is the slit cutting edge 3. Since all cutting edges are driven by one motor in spite of being unnecessary, they are the network cutting edges 1 and 2. Slit cutting edge 3 It moves to coincidence. moreover -- the time of a trimer -- trimer cutting edge 4 not only -- one transfer member E since each cutting edge is connected -- network cutting edges 1 and 2 Slit cutting edge 3 It moves to coincidence. Therefore, even an unnecessary cutting edge will be moved, that is, the speed was not able to be separately controlled for every cutting edge. Therefore, consumed the cell vainly, consumption of a cutting edge was brought forward, and there were troubles, like the skin is hot by generation of heat by friction produced by the drive of a cutting edge.
[0005] This invention is made in order to cancel such a fault, and it aims at offering the electric shaver which can drive each cutting edge efficiently according to a service condition.
[0006]
[Means for Solving the Problem] In order to solve this technical problem, an electric shaver according to claim 1 The motor as a driving source, and the transfer member which changes

the output of a motor into reciprocation, The trimer cutting edge which consists of a movable cutting edge which reciprocates while touching this stationary knife by the stationary knife and transfer member of a pectinate form, In the electric shaver equipped with one or more head cutting edges which consist of inner cutting edges which reciprocate while touching the inside of an outside [this] cutting edge by the outside cutting edge with which many blade holes were prepared, and the transfer member Said motor and two transfer members each are prepared, and it is considering as the configuration which connected one of these with the trimer cutting edge, and connected another side with the head cutting edge.

[0007] Moreover, an electric shaver according to claim 2 is set to an electric shaver according to claim 1. The motor as a driving source, and the transfer member which changes the output of a motor into reciprocation, In the electric shaver equipped with the head cutting edge which consists of two network cutting edges which consist of inner cutting edges which reciprocate while touching the inside of an outside [this] cutting edge by the outside cutting edge with which many small blade holes were prepared, and the transfer member Said motor and two transfer members each are prepared, and it is considering as the configuration which connected each with two network cutting edges separately.

[0008] Moreover, the electric shaver according to claim 3 is considered as the configuration which established a motor current detection means to detect a motor current, and the control means which controls the rotational frequency of said motor by the current value in the electric shaver according to claim 2.

[0009] Moreover, the electric shaver according to claim 4 is considered as the configuration which established the piezoelectric device prepared near the network cutting edge which detects the forcing force of the skin to said network cutting edge, and the control means which controls the rotational frequency of said motor by the electrical-potential-difference value in the electric shaver according to claim 2.

[0010] Moreover, the electric shaver according to claim 5 is considered as the configuration which established the acceleration sensor prepared near the network cutting edge which detects the direction from which said network cutting edge is moved along with the skin, and the control means which controls the rotational frequency of said motor by the electrical-potential-difference value in the electric shaver according to claim 2.

[0011] Moreover, the transfer member from which an electric shaver according to claim 6 changes the output of the motor as a driving source, and a motor into reciprocation, Two network cutting edges which consist of inner cutting edges which reciprocate while touching the inside of an outside [this] cutting edge by the outside cutting edge with which many small blade holes were prepared, and the transfer member, In the electric shaver equipped with the becoming head cutting edge the slit cutting edge which consists of an inner cutting edge which reciprocates while touching the inside of an outside [this] cutting edge by the outside cutting edge with which it was prepared between them and the blade hole of the shape of much slit was prepared, and the transfer member -- since -- Said motor and two transfer members each are prepared, and it is considering as the configuration which connected one of these with the network cutting edge, and connected another side with the slit cutting edge.

[0012] Moreover, the electric shaver according to claim 7 is considered as the configuration which established a motor current detection means to detect a motor current, and the control means which controls the rotational frequency of said motor by the current value in the electric shaver according to claim 6.

[0013] Moreover, the electric shaver according to claim 8 is considered as the timer counter which measures the operating time, and the configuration which established the rotation means for stopping of the motor which will suspend a slit cutting edge if it becomes the setup time in the electric shaver according to claim 6.

[0014]

[Function] According to the configuration according to claim 1, an electric shaver can drive a trimer cutting edge and a head cutting edge independently respectively by switching by SUITCHI.

[0015] According to the configuration according to claim 2, an electric shaver can control two network cutting edges independently respectively by switching by SUITCHI.

[0016] According to the configuration according to claim 3, the current which does so an operation according to claim 2, and also flows on a motor is detected, and revolving speed control of the motor according to it can be performed.
[0017] According to the configuration according to claim 4, the load which does so an operation according to claim 2, and also is applied to a piezoelectric device is detected, and revolving speed control of the motor according to it can be performed.
[0018] According to the configuration according to claim 5, an operation according to claim 2 is done so, and also the polarity of an acceleration sensor is detected, and on-off control of the motor according to it can be performed.
[0019] According to the configuration according to claim 6, an electric shaver can control a network cutting edge and a slit cutting edge independently respectively.
[0020] According to the configuration according to claim 7, the current which does so an operation according to claim 6, and also flows on a motor is detected, and revolving speed control of the motor according to it can be performed.
[0021] According to the configuration according to claim 8, an operation according to claim 6 is done so, and also the operating time is counted, and the motor of a slit cutting edge is suspended by fixed time amount.
[0022]
[Example] Hereafter, the 1st example of this invention is explained based on drawing 1 thru/or drawing 4 . In addition, what was explained in the conventional example, and a fundamental function give the same sign to the same member. the electric shaver in this example is shown in the sectional view of the electric shaver of drawing 1 -- as -- head cutting edge A it is -- two network cutting edges 1 and 2 Slit cutting edge 3 in the meantime Housing B of an electric shaver Trimer cutting edge 4 formed in the side face It has four becoming cutting edges.
[0023] 1 2 It is a network cutting edge and they are the inner cutting edges 1a and 2a respectively. Outside cutting-edge 1b which touches the outside, and 2b It is constituted. One inner cutting-edge 1a is drive child 11a mentioned later. Inner cutting-edge 2a of another side is drive child 11b. It is engaged, respectively. These inside cutting edges 1a and 2a It is metal tabular, it is arranged in the shape of juxtaposition that it is also at nothing and predetermined spacing about the letter of the abbreviation for U characters, and they are outside cutting-edge 1b and 2b. It has many small blade holes, and is formed in plate-like with a metallic thin plate, and they are the inner cutting edges 1a and 2a as a result. It corresponds and is attached in the shape of abbreviation for U characters. These network cutting edges 1 and 2 It is a cutting edge for finishing and is fit for shaving a mustache deeply.
[0024] 3 It is a ** slit cutting edge and consists of inner cutting-edge 3a and outside cutting-edge 3b. Inner cutting-edge 3a is drive child 11b which makes the shape of an abbreviation KO character and also mentions this later. It is engaged and, as for outside cutting-edge 3b, many blade holes of the shape of nothing and a slit have opened the shape of a profile KO character. This slit cutting edge 3 It is a cutting edge for rough-planed, and a long mustache is shaved coarsely.
[0025] 4 It is a ** trimer cutting edge and consists of movable cutting-edge 4a and stationary-knife 4b of a pectinate form. Trimer cutting edge 4 Slide section 5 Housing B Drive child 11c later mentioned by meeting and moving upward It joins. This trimer cutting edge 4 Hair, such as sideburns, is cut.
[0026] 6a and 6b It is a motor for a drive and is the housing B of an electric shaver. It is contained together with inside. 7 SUITCHI for ******** -- housing B of an electric shaver it being prepared in a side face and sliding -- motor 6a -- cell 8 or motor 6b -- cell 8 It connects electrically.
[0027] C and D a transfer member -- it is -- one transfer member C Eccentric-cam 9a and drive arm 10a which are connected to motor 6a Drive children 11a and 11b from -- becoming -- transfer member D of another side Eccentric-cam 9b and drive arm 10b which are connected to motor 6b Drive child 11c from -- it becomes. And both transfer members C and D Motors 6a and 6b Rotation is changed into a straight-line reciprocating motion. The above-mentioned drive child 11b Drive child 11a It is engaged and both do the same motion.
[0028] Drawing 3 is Motors 6a and 6b. SUITCHI 7 It is schematics and is a cell 8. It receives

and is SUITCHI 7 to a serial. This SUITCHI 7 It minds and they are Motors 6a and 6b to juxtaposition. It connects.

[0029] By making it such a configuration, it is SUITCHI 7. For example, the network cutting edges 1 and 2 and the slit cutting edge 3 By switching to an active position motor 6a -- rotating -- therefore, transfer member C it is -- eccentric-cam 9a, drive arm 10a, and drive children 11a and 11b head cutting edge A which is engaging with it it is -- network cutting edges 1 and 2 Inner cutting edges 1a and 2a Slit cutting edge 3 Inner cutting-edge 3a can carry out a straight-line reciprocating motion, and can shave a mustache. In this case, trimer cutting edge 4 It is the transfer member D to movable cutting-edge 4a. Motor 6b connected by passing is the trimer cutting edge 4, in order not to rotate. It does not drive. next, SUITCHI 7 Trimer cutting edge 4 switching to an active position -- motor 6b -- rotating -- therefore, transfer member D it is -- eccentric-cam 9b, drive arm 10b, and drive child 11c Trimer cutting edge 4 Movable cutting-edge 4a carries out a straight-line reciprocating motion. In this case, other head cutting edges A It does not drive.

[0030] In addition, SUITCHI 7 is Motors 6a and 6b like drawing 4 . What was allotted to the serial may be arranged to two-piece juxtaposition. While one of motors are driving in that case, in addition, it is good to establish the lock device in which SUITCHI of another side does not enter carelessly. Moreover, it is not limited to this example and the number of cutting edges is the head cutting edge A. Various things, such as a case of one network cutting edge or two cases, can set up suitably.

[0031] Next, the 2nd example of this invention is explained based on drawing 5 and drawing 6 R> 6. Drawing 5 is a circuit diagram and drawing 6 is a flow chart. Head cutting edge A Two network cutting edges 1 and 2 Slit cutting edge 3 It is formed and let a trimer cutting edge be the electric shaver which is not attached.

[0032] In this example, the partial change of the structure of a transfer member is carried out to a previous example. That is, although one transfer member is the same as that of the transfer member of a previous example, and abbreviation, he is trying not to engage a slit cutting edge. And while the transfer member of another side has an eccentric cam, a drive arm, and a drive child so that rotation of motor 6b may be changed into a straight-line reciprocating motion, the drive child forms so that it may engage with a slit cutting edge. Consequently, network cutting edges 1 and 2 It connects with motor 6a for a drive through a transfer member, and is the slit cutting edge 3. It connects with motor 6b through another transfer member. Network cutting edges 1 and 2 Slit cutting edge 3 Structure is the same as the 1st example, and explanation is omitted here.

[0033] Q1 and Q2 Motors 6a and 6b The transistor to control, and R1 and R2 the resistance and CPU which are a motor current detection means for detecting a mustached shade Resistance R1 and R2 The flowing current is detected, it inputs as an electrical potential difference, the value is judged, and they are transistors Q1 and Q2. The microcomputer which outputs a signal to the base, and SW are the cell 8 which is a power source. It is SUITCHI which has entered and is carried out. And a transistor Q2, motor 6b, and resistance R2 are also allotted to a serial by the serial, and the each is arranged for a transistor Q1, motor 6a, and resistance R1 at juxtaposition.

[0034] When SUITCHI SW is turned on by making it such a configuration, they are transistors Q1 and Q2. It turns on and they are Motors 6a and 6b. It operates, therefore they are the network cutting edges 1 and 2 and the slit cutting edge 3. It drives. Here, they are Motors 6a and 6b. The flowing currents are resistance R1 and R2. It is detected, namely, they are electrical potential differences VR1 and VR2. It is detected by carrying out and is Microcomputer CPU. It is inputted. Microcomputer CPU These electrical potential differences VR1 and VR2 Electrical potential differences V1 and V2 which considered as the average electrical potential difference per unit time amount, and were set up beforehand If either is large, they are transistors Q1 and Q2. The signal to turn off is not taken out, therefore they are Motors 6a and 6b. Although driven as it is electrical potential differences VR1 and VR2 **** -- when it became smaller than the set-up electrical potential difference, the mustache decreased -- judging -- a transistor Q2 -- turning off -- motor 6b3, i.e., a slit cutting edge, It operates so that it may stop. And microcomputer CPU After that is an electrical potential difference VR 1. It

detects and is an electrical potential difference VR 1. If it becomes larger than the set-up electrical potential difference V1, a transistor Q2 is turned on again, and it is the slit cutting edge 3. It operates so that it may drive. In this case, especially the transistors Q1 are the network cutting edges 1 and 2, although it is unnecessary. It can use to control operation.

[0035] In addition, head cutting edge A It is good two network cutting edges, in the case of two network cutting edges, a transfer member is minded for motor 6a, and it is the network cutting edge 1. It connects with inner cutting-edge 1a, a transfer member is minded for motor 6b, and it is the network cutting edge 2. It connects with inner cutting-edge 2a.

[0036] Next, the 3rd example of this invention is explained based on drawing 5 and drawing 7 R> 7. The head cutting edges A are two network cutting edges 1 and 2. It is formed and motor 6a is the network cutting edge 1. Motor 6b is the network cutting edge 2. It connects. For this thing, the 2nd example is the head cutting edge A. The flow charts of a configuration and a microcomputer differ.

[0037] When SUITCHI SW turns on by making it such a configuration, they are transistors Q1 and Q2. It turns on and they are Motors 6a and 6b. It operates, therefore they are the network cutting edges 1 and 2. It drives. Here, they are Motors 6a and 6b. The flowing currents are resistance R1 and R2. It is detected and they are electrical potential differences VR1 and VR2. It carries out and is Microcomputer CPU. It is inputted. These electrical potential differences VR1 and VR2 It considers as the average electrical potential difference per unit time amount, and they are these electrical potential differences VR1 and VR2. Electrical potential differences V1 and V2 set up beforehand They are transistors Q1 and Q2 by the output compare and corresponding to it. It turns on. namely, the time of VR1 >=V2 -- a transistor Q1 -- always -- ON -- carrying out -- V1 <=VR1 -- < -- the time of V2 -- a transistor Q1 -- a pulse -- two thirds only -- turning on -- VR1 -- < -- the time of V1 -- a transistor Q1 -- a pulse -- one third only -- it turns on. That is, this circuit operates as a kind of phase control circuit. In addition, if ON time amount is short, motor 6a will become low-speed rotation. moreover, the way of motor 6b -- being the same -- namely, the time of VR2 >=V2 -- a transistor Q2 -- always -- ON -- carrying out -- V1 <=VR2 -- < -- the time of V2 -- a transistor Q2 -- a pulse -- two thirds only -- turning on -- VR2 -- < -- the time of V1 -- a transistor Q2 -- a pulse -- one third only -- it turns on. In addition, motors 6a and 6b Controlling a rotational frequency not only adjusts the size of a rotational frequency, but it includes turning on and off.

[0038] Next, the 4th example of this invention is explained based on drawing 8 thru/or drawing 11. Head cutting edge A Two network cutting edges 1 and 2 It is formed and motor 6A is the network cutting edge 1. Motor 6b is the network cutting edge 2. It connects.

[0039] 12a and 12b It is a piezoelectric device and they are the network cutting edges 1 and 2. Inner cutting edges 1a and 2a which are near It is prepared in the lower limit and they are the network cutting edges 1 and 2. The forcing force is sensed.

[0040] As the circuit of this example is shown in drawing 10, as for a transistor Q1 and motor 6a, a transistor Q2 and motor 6b are also allotted to a serial by the serial, and that each is arranged at juxtaposition. Piezoelectric devices 12a and 12b An output is Microcomputer CPU. It is inputted and they are transistors Q1 and Q2. It is Microcomputer CPU to the base. The output is connected.

[0041] When SUITCHI SW is turned on by making it such a configuration, they are transistors Q1 and Q2. It is turned on and they are Motors 6a and 6b. It operates and they are the network cutting edges 1 and 2. It drives. here -- the skin -- network cutting edges 1 and 2 pushing -- outside cutting-edge 1b, 2b, and inner cutting edges 1a and 2a it pushes caudad -- having -- piezoelectric devices 12a and 12b Each network cutting edge 1 and 2 the applied forcing force -- detecting -- electrical potential differences VA1 and VA2 ****** -- it inputs into a microcomputer. Electrical potential differences VA1 and VA2 It is judged that the forcing force is large, so that it is large. These electrical potential differences VA1 and VA2 Electrical potential differences V1 and V2 set up beforehand They are transistors Q1 and Q2 by the output compare and corresponding to it. It turns on. the 3rd example -- the same -- the time of VA1 >=V2 -- a transistor Q1 -- always -- ON -- carrying out -- V1 <=VA1 -- < -- the time of V2 -- a transistor Q1 -- a pulse -- two thirds only -- turning on -- VA1 -- < -- the time of V1 -- a transistor Q1 -- a pulse -- one third only -- it turns on. moreover, the time of VA2 >=V2 -- a

transistor Q2 -- always -- ON -- carrying out -- V1 <=VA2 -- < -- the time of V2 -- a transistor Q2 -- a pulse -- two thirds only -- turning on -- VA2 -- < -- the time of V1 -- a transistor Q2 -- a pulse -- one third only -- it turns on. Transistors Q1 and Q2 By changing the time amount to turn on, they are Motors 6a and 6b. A rotational frequency is changed. When the forcing force is large, it moves at the maximum rotational frequency, and when the forcing force is small, it is made to make a rotational frequency low.

[0042] In addition, piezoelectric devices 12a and 12b Attaching positions are the inner cutting edges 1a and 2a. If it is near [which can detect the forcing force of not only a lower limit but the skin] the network cutting edge, it is good anywhere.

[0043] Next, the 5th example of this invention is explained based on drawing 9 , drawing 12, and drawing 13. Head cutting edge A Two network cutting edges 1 and 2 It is formed and motor 6a is the network cutting edge 1. Motor 6b is the network cutting edge 2. It connects.

[0044] 13 is an acceleration sensor and is the network cutting edges 1 and 2. Network cutting edges 1 and 2 which are near It is prepared in the interior and is the head cutting edge A to the skin. It detects in which direction it moves. That is, it is the network cutting edge 1 to the skin. Whether it contacts previously and network cutting edge 2 It detects whether it contacts previously.

[0045] As the circuit of this example is shown in drawing 12, as for a transistor Q1 and motor 6a, a transistor Q2 and motor 6b are also allotted to a serial by the serial, and that each is arranged at juxtaposition. And the output of an acceleration sensor 13 is Microcomputer CPU. It is inputted and they are transistors Q1 and Q2. It is Microcomputer CPU to the base. It connects so that an output may be inputted.

[0046] By making it such a configuration, it is the head cutting edge A of an electric shaver to the skin by the polarity of the electrical potential difference VK of an acceleration sensor 13. It is detectable to which direction it is moving. if an electrical potential difference VK is forward -- network cutting edge 1 from -- network cutting edge 2 if it moves to a direction and is negative -- network cutting edge 2 from -- network cutting edge 1 It is moving to the direction. They are two network cutting edges 1 and 2 about the head cutting edge A. When it forms, the network cutting edge which touches the skin first raises the mustache which is sleeping, and since there is a duty which inserts a mustache into the network cutting edge by which it comes to the next, especially the first network cutting edge does not need to be operating. Therefore, if an electrical potential difference VK is forward, a transistor Q1 is turned off, and it is the network cutting edge 1. Motor 6a is stopped, if an electrical potential difference VK is negative, a transistor Q2 is turned off, and it is the network cutting edge 2. By stopping motor 6b, they are the network cutting edges 1 and 2 efficiently. It can drive.

[0047] In addition, the attaching positions of an acceleration sensor 13 are the network cutting edges 1 and 2. Not only the interior but head cutting edge A Network cutting edges 1 and 2 which can detect moving If it is near, it is good anywhere.

[0048] Next, the 6th example of this invention is explained based on drawing 14 and drawing 15. The head cutting edges A are two network cutting edges 1 and 2. Slit cutting edge 3 It is formed and let a trimer cutting edge be the electric shaver which is not attached. Motor 6a is the network cutting edges 1 and 2. Motor 6b is the slit cutting edge 3. It connects.

[0049] As the circuit of this example is shown in drawing 14, as for a transistor Q1 and motor 6a, a transistor Q2 and motor 6b are also allotted to a serial by the serial, and that each is arranged at juxtaposition. Microcomputer CPU Outputs are transistors Q1 and Q2. It connects with the base and is Microcomputer CPU. A timer counter is inside.

[0050] When SUITCHI SW is turned on by making it such a configuration, a signal is outputted from Microcomputer CPU and they are transistors Q1 and Q2. It is turned on and they are Motors 6a and 6b. It operates and they are the network cutting edges 1 and 2 and the slit cutting edge 3. It drives. it, simultaneously microcomputer CPU Time amount T to which the inner timer counter started the count and was set beforehand Microcomputer CPU which is the rotation means for stopping of a motor when it passes from -- the signal which turns off a transistor Q2 is outputted and motor 6b stops a drive. Slit cutting edge 3 connected to motor 6b by making it such a configuration It is not made to drive superfluously. Especially in this example, although it is unnecessary, a transistor Q1 can be used, when controlling motor 6a.

[0051]
[Effect of the Invention] Since an electric shaver according to claim 1 can drive a trimer cutting edge and a head cutting edge independently respectively by switching by SUITCHI and only a required cutting edge can be efficiently used for it, the life of a cutting edge is not only extended, but its consumption of a cell decreases.
[0052] Since an electric shaver according to claim 2 can control two network cutting edges independently respectively by switching by SUITCHI, it can perform control of the cutting edge according to a busy condition.
[0053] Since an electric shaver according to claim 3 detects the current which does the effectiveness of claim 2 so, and also flows on a motor and can perform revolving speed control of the motor according to it, it detects a mustached shade and can perform the drive of the optimal cutting edge.
[0054] Since an electric shaver according to claim 4 detects the load which does the effectiveness of claim 2 so, and also is applied to a piezoelectric device and can perform revolving speed control of the motor according to it, it detects the forcing force concerning a cutting edge, and can perform the drive of the optimal cutting edge.
[0055] Since an electric shaver according to claim 5 does the effectiveness of claim 2 so, and also detects the polarity of an acceleration sensor and can perform on-off control of the motor according to it, it detects the direction which a mustache shaves and can perform the drive of the optimal cutting edge.
[0056] Since an electric shaver according to claim 6 can control a network cutting edge and a slit cutting edge independently respectively, it can perform control of the cutting edge according to a busy condition.
[0057] Since an electric shaver according to claim 7 detects the current which does the effectiveness of claim 6 so, and also flows on a motor and can perform revolving speed control of the motor according to it, it detects a mustached shade and can perform the drive of the optimal cutting edge.
[0058] Since an electric shaver according to claim 8 does the effectiveness of claim 6 so, and also counts the operating time and suspends the motor of a slit cutting edge by fixed time amount, it does not have the problem too much which a cutting edge uses.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is a small electrical machinery and apparatus like an electric shaver, and relates to the thing equipped with the function for detecting especially the size of a load.
[0002]
[Description of the Prior Art] If it is in this kind of small electrical machinery and apparatus conventionally, while making the rotational speed of a motor change by making the magnitude of the direct current voltage impressed to a motor fluctuate, it uses that the magnitude of the load current changes corresponding to the size of a load load which joins a motor, and what makes size of a load detectable is proposed (for example, refer to JP,5-38387,A and JP,5-200168,A).
[0003]
[Problem(s) to be Solved by the Invention] By the way, if it is when driving a motor with direct current voltage as mentioned above, since value itself of the motor current at the time of the stationary to which a load load is not impressed is stable, it is not so difficult to detect the increment in the motor current resulting from impression of a load load.
[0004] However, even if it is before a load load is added if it is when carrying out the pulse drive of the motor, as a result of motor current itself showing the fluctuation corresponding to the duty ratio of driver voltage, it is difficult to overlap the fluctuation of driver voltage and the fluctuation of a load load in a motor current, and to separate and detect both.
[0005] On the other hand, in the range where the duty ratio of a motorised electrical potential difference is small, and the large range, although it was also possible to have compared with a compound value the detection electrical potential difference which integrated with change of a motor current and took the average value, as a result of the fluctuation rates of a detection electrical potential difference to fluctuation of a load load differing, a setup of a comparison electrical potential difference was difficult, and there was un-arranging [which is incorrect-detected sometimes].
[0006] An example is taken inconvenient and it is made, and this invention makes detection possible, without incorrect-detecting the magnitude of a load, maintaining a comparatively easy configuration by [this] changing the criteria for detection corresponding to the magnitude of the duty ratio of driver voltage, and it aims at offering the small electrical machinery and apparatus which can perform exactly control action of the contents corresponding to the detection actuation.
[0007]
[Means for Solving the Problem] As the rough configuration is shown in drawing 1 , the small electrical machinery and apparatus concerning this invention is interlocked with impression of the direct current voltage outputted from DC power supply 71 like a rechargeable battery, responds to carrying out change which the duty ratio in the applied voltage illustrates to drawing 10 , and is equipped with the driving means 72 which operates at the rate of predetermined.
[0008] Furthermore, the load current detection means 73 which enables the output of the detection signal which changes corresponding to the magnitude of the load current which flows

to a driving means 72, The magnitude of the detection signal detected with the load current detection means 73 and the comparison signal S set up beforehand is compared, and it has the comparison means 74 which enables predetermined judgment actuation corresponding to both size relation, and the control means 75 whose modification of the duty ratio of the applied voltage to a driving means 72 is enabled.

[0009] It is the comparison signal further described above if it was in this invention two or more sets S1 and S2 ... While having, the comparison means 74 is characterized by changing the comparison signal S and performing comparison actuation corresponding to the difference in the duty ratio of the applied voltage used for the drive of a driving means 72.

[0010] A driving means 72 is a DC motor and the load current detection means 73 consists of a driving means 72, resistance 76 infixed in the serial, and an integral means 77 to integrate with the electrical potential difference taken out from the both ends of the resistance 76, further here.

[0011] The above mentioned comparison signal can be made into 2 sets, S1 and S2, and the comparison signal of each class can consist of further 1 or two or more comparison electrical potential differences. In that case, a load current detection means 73 can prepare the range of a detection electrical potential difference which is illustrated to comparatively large drawing 11 (b) of voltage variation by setup of the time constant in the integral means 77 corresponding to the electrical potential difference impressed to a driving means 72 being intermittent, and the range of the comparatively small detection electrical potential difference of voltage variation like drawing 11 (a), and can perform a switch of the comparison signal in the comparison means 74 corresponding to the size of the voltage-variation rate of a detection electrical potential difference.

[0012] In the above mentioned control means 75, while carrying out on-off control of the switching means 78 and enabling modification of the working speed of a driving means 72 in two or more steps by impressing the driving signal with which a duty ratio changes to two or more steps to the switching means 78 connected to the driving means 72 and the serial, corresponding to modification of the duty ratio in a driving signal, the comparison signal used at the time of comparison actuation is determined.

[0013] Moreover, the above mentioned control means 75 enables modification of the duty ratio of a driving signal automatically corresponding to the judgment activity in the comparison means 74. Furthermore, modification of the automatic driving signal which was interlocked with change actuation of an actuation means 79 like a pushbutton switch, and was described above, and a change by hand control are made switchable.

[0014] Moreover, as for the motor of a driving means 72, it is desirable that make the inner cutting edge of an electric shaver drive, and the control state of the control state display means 80 which indicates the rate change of a driving means 72 by the phase, and a control means 75 is further equipped with automatic or a contents display means 81 of control to display a manual difference, and the control state display means 80, the contents display means 81 of control, and the actuation means 79 approach in the state of a single tier, and are arranged.

[0015]

[Effect of the Invention] Maintaining a comparatively easy configuration by changing the criteria for detection like the above corresponding to the magnitude of the duty ratio of driver voltage, this invention carries out detection possible, without incorrect-detecting the magnitude of a load, and can perform exactly control action of the contents corresponding to the detection actuation.

[0016] Furthermore, detection corresponding to fluctuation of a load load can be exactly performed by carrying out by what carried out smooth [of the electrical potential difference which generates detection of a load to the both ends of the resistance 76 connected with the driving means 72 and the serial] with the integral means 77.

[0017] Moreover, in the range with little level variation, the average compares, and by carrying out on two kinds of criteria compared with peak value, the difference in the difficult minute load effect dissociates correctly, and can detect the judgment of the size of the load current on one criteria in the large range of fluctuation.

[0018] Furthermore, detection actuation of the load current is performed, without detecting the

working speed of a driving means 72 by [which constitute like] determining the comparison signal used making correspond to modification of a driving signal, while the rate is changed again by the driving signal by which a driving means 72 is outputted from a control means 75.
[0019] Moreover, by performing control which makes the working speed of a driving means fluctuate corresponding to the magnitude of the detected load load, if it is for example, at the time of shaving, the inner cutting-edge rate corresponding to mustached thickness is obtained automatically.
[0020] Furthermore, since it is arranged, while the control state display means 80, the contents display means 81 of control, and the actuation means 79 look at the control state close to a single-tier condition displayed clearly, mode change actuation by the actuation means 79 can be performed exactly.
[0021]
[Embodiment of the Invention] Although the small electrical machinery and apparatus built over this invention below is explained based on an example carried out to the electric shaver of the rotary system illustrated to drawing 2 , of course, it can carry out like abbreviation also to various kinds of small electrical machinery and apparatus, such as an electric shaver which not only this but an inner cutting edge rotates to the circumference of a reciprocation type or an axis of ordinate or a massager equipped with the speed-control function of a drive part like a motor or vibrator of operation, an electric toothbrush, or pawl polishing.
[0022] As shown in drawing 2 , the upper part equips it with it for the head section 13 which carried out opening, enabling free rocking while an electric shaver 10 contains the inner cutting edge 12 in the upper limit location of the body case 11, and it is arranging in it the outside cutting-edge holder 15 equipped with the cutting edge 14 outside the shape of **** which touches the inner cutting edge 12 so that opening in the head section 13 may be closed further.

[0023] The inner cutting edge 12 is connected by the moderation device which becomes a peripheral surface from two or more steps of gears or the timing belt which prepared the spiral cutting part, and which does not illustrate between the revolving shaft 16 of one of these, and the revolving shaft of a motor 17 while it is cylindrical, and extending a revolving shaft 16 in the direction of outside and supporting it horizontally from the both ends in the upper part in the head section 13.
[0024] Moreover, the main switch 19 for carrying out on-off regulation of the motor 17 on the control panel 18 which travels in the center section in the transverse-plane side of the body case 11, and is extended to thin band-like one in the vertical direction, The 1st display 21 equipped with three light emitting device 20a, 20b, and 20c for displaying the drive rate of a motor 17, The 2nd display 22 for displaying the drive mode of a motor 17, and the subswitch 23 for changing the drive condition of a motor 17, While arranging the 3rd display 24 which displays a charge stage in the state of a single tier, a control panel 18 is surrounded and it has the 4th display 25 which enables the display of the remaining capacity of a cell like drawing 3 .
[0025] Moreover, the socket 28 which enables connection of the plug 27 of the charge adapter 26 free [insertion and detachment] is formed in the lower limit location of the body case 11, and the electronic circuitry 31 shown in drawing 4 contained in the body case 11 enables it to drive using a commercial alternating current power source.
[0026] The charge adapter 26 enables the output of the charge electrical potential difference Vd of about [4V] direct-current low voltage for example, a little higher than the terminal voltage Ve of a rechargeable battery 36 by rectifying, after lowering the pressure of the about [100-250V] commercial alternating current electrical potential difference 30 inputted through the plug 29 by the inverter circuit which the same configuration as the former and abbreviation does not illustrate.
[0027] Moreover, whenever a normally open push-type [for example,] switch is used and a main switch 19 and the subswitch 23 carry out one push actuation, an electronic circuitry 31 performs actuation which carries out a postscript and which was set up beforehand.
[0028] The 1st - the 3rd display 21-22-24 make possible the predetermined display action to which driver voltage like the light emitting diode of a red system carries out the postscript of the light emitting device lower than cell voltage 1 or by making more than one estrange, and

changing the display configuration or foreground color, having in the state of a column, and changing the lighting location or flashing condition of a light emitting device.

[0029] The 2nd display 22 sets it as yellow, and, more specifically, the 3rd light-emitting part 24 has set all of the color of three light emitting devices 20 in the 1st display 21 as red green. Thus, since a motion of the 1st display 21 can be seen on the basis of the 2nd display 22 by changing the foreground color in the 1st display 21 and the 2nd display 22, the rotational speed of a motor 17 can be judged quickly visually. Especially this is useful, when the display in the 1st display 21 fluctuates not individual lighting but the number of lightings and it displays rotational speed.
 [0030] On the other hand, like drawing 3 (b), a light emitting device 32 like LED of a blue system is used, and the 4th display 25 does not emit directly the light outputted further. While bending in the direction of a right angle using prism 33 and inputting into the lower limit of a light guide plate 34, it constitutes in the shape of a field by emitting light to the exterior of the body case 11 from the optical diffusion plate 35 which was made to stick to the front-face side of a light guide plate 34, and was arranged so that it may indicate by luminescence.

[0031] Furthermore, if it is in this example, while going around the perimeter of the above-mentioned control panel 18 and exposing the optical diffusion plate 35 to thin band-like one The reinforcement of the light 61 outputted from the optical diffusion plate 35 covers the whole surface, and by setting up so that it may decrease as it is not the same and the light by which incidence was carried out to the light guide plate 34 progresses upwards The 4th display 25 is made to emit light in abbreviation a configuration for U characters like drawing 3 (a) which becomes so dark that the lowest edge goes upwards most brightly at the time of lighting of a light emitting device 32.

[0032] Next, the electronic circuitry 31 contained in the body case 11 As the overall configuration is roughly shown in drawing 4 , it is that by which the whole is controlled by 1 chip type microcomputer equipment 37 by making into a driving source the rechargeable battery 36 which makes the charge and discharge of multiple times possible. It consists of a charge control section 38 which regulates the charge stage to a rechargeable battery 36, a cell residue detecting element 39 which enables the display corresponding to the cell residue under drive by the rechargeable battery 36, and the motor control section 40 whose modification of the drive condition of a motor 17 is enabled.

[0033] The microcomputer equipment 37 used by this invention is the general-purpose thing equipped with two or more input port of analog voltage, and it enables it only for microcomputer equipment 37 to perform it by building the function as an A/D converter in one, without the control action corresponding to the analog voltage value change inputted using discrete part like an A/D converter or a comparator by the program which ROM-ized inside and was contained inside.

[0034] That is, after changing into the predetermined digital value of about 8 bits the electrical-potential-difference value inputted into the input port of an analog signal as compared with the partial pressure value of the reference voltage VS stabilized in the voltage stabilizer 41, the digital value after conversion is compared suitably and predetermined operation actuation is performed corresponding to the size. And the A/D-conversion function with which this microcomputer equipment 37 is equipped, and the calculation function by the program are used, and the display or control action corresponding to various kinds of detection and the contents of detection of those is made to perform.

[0035] A rechargeable battery 36 is a nickel hydoride battery, and if it is in this example, that to which the terminal voltage Ve changes from the condition made to discharge completely to about 1.8V-3.5V with charge is used by connecting two to a serial. However, of course, the class or number of a cell can be changed.

[0036] The charge control section 38 enables charge over a rechargeable battery 36 by impressing the charge electrical potential difference Vd outputted from the charge adapter 26 to the both ends of a rechargeable battery 36 through the thermal fuse 43 melted at the time of the 1st transistor 42 which it had as an object for switching, and overheating, as the concrete configuration is shown in drawing 5 .

[0037] That is, when the charge electrical potential difference Vd is inputted, the 2nd transistor

44 connected to the base edge of the 1st transistor 42 turns on first, the 1st transistor 42 is made to turn on further, and the charge over a rechargeable battery 36 is made to start. It indicates that it energizes to the light emitting device 45 with which the 3rd display 24 was equipped, and it and coincidence are under charge.

[0038] Furthermore, an operator is both told about having also stopped energization of as opposed to the light emitting device 45 of the 3rd display 24 as if the 2nd transistor 44 and the 1st transistor 42 turning off as a result of microcomputer equipment 37 making the 3rd transistor 46 turn on if it reaches at the completion stage of charge, and the charge over a rechargeable battery 36 being suspended, and charge having been completed.

[0039] Especially the approach of detecting the full charge stage of the rechargeable battery 36 described above here is not limited. However, it uses carrying out change which the terminal voltage Ve at the time of charge of a nickel hydoride battery illustrates by drawing 6 (a), if it is in this example. By inputting into microcomputer equipment 37 the electrical potential difference which is proportional to cell voltage Ve through the cell voltage detecting element 47 which pressures cell voltage Ve partially, and detecting the electrical-potential-difference change It is based on only further predetermined electrical-potential-difference deltaV judging B the time of terminal voltage Ve falling to be the time of a full charge, and carrying out halt control of the boosting charge from the time A of the terminal voltage Ve of a rechargeable battery 36 reaching peak value ****.

[0040] Furthermore, if the longest charging time passes in consideration of the case where it originates in degradation of a rechargeable battery 36 etc., and peak value **** cannot be detected, without setting up the longest charging time of about 1 hour beforehand by the timer function in microcomputer equipment 37, and detecting a peak location from charge initiation, charge will be suspended compulsorily.

[0041] Even if it is when it is checked that the condition more than laying temperature had maintained only the setup time for about 10 seconds after the cell temperature detector 49 using a thermistor 48 detects the skin temperature of a rechargeable battery 36 to coincidence and the temperature reaches it at the set point for example, overcharge is prevented by judging it as what reached the full charge, and suspending charge.

[0042] In addition, it has the AC detecting element 63 which consists of a transistor 62 turned on at the time of the input of the charge electrical potential difference Vd, and uses at the time of various kinds of control action including the charge control which enabled the judgment of the input stage of the charge electrical potential difference Vd, and described it above.

[0043] Next, if remaining capacity detection and a display of a rechargeable battery 36 use that terminal voltage Ve falls with use of a rechargeable battery 36 so that it may illustrate to drawing 6 (b), for example, they are in this example, the time of terminal voltage Ve reaching the 1st compound value V1, C judges with a full charge condition, always turns on the light emitting device 32 in the 4th display 25, and indicates by the full charge.

[0044] Furthermore, terminal voltage Ve is less than the 1st compound value V1, and when D blinks a light emitting device 32 slowly at intervals of about 1 second, makes a charge preliminary announcement display perform and is less also than V2, it makes the display-control actuation from which it moves to the charge reminder display which shortens a flashing period perform the time of amounting to V2 which is the 2nd compound value.

[0045] In order to realize the above-mentioned actuation, if it is in this example, as shown in drawing 7 , the 1st above mentioned compound value V1 and the 2nd above mentioned compound value V2 are formed by making into the reference voltage VS at the time of A/D conversion the electrical potential difference stabilized in the voltage stabilizer 41, and pressuring the electrical potential difference partially in the comparison electrical-potential-difference generating circuit 50 further.

[0046] The rechargeable battery electrical potential difference Ve is pressured partially in the cell voltage input circuit 51, and it inputs into microcomputer equipment 37, and by carrying out the comparison operation of the input value, the above mentioned compound value V1, and V2, a current cell residue is judged to coincidence and the judgment result is displayed on it by the 4th display 25.

[0047] By the way, if it is in this example, the light emitting device with driver voltage higher

than the terminal voltage Ve of a rechargeable battery 36 is used like LED of a blue system as a light emitting device 32 with which the 4th display 25 is equipped.
[0048] Then, once raising the terminal voltage Ve of a rechargeable battery 36 to an electrical potential difference required for the display in the 4th display 25 in a booster circuit 52, it is impressed by the light emitting device 32. Furthermore, since the current which flows to the light emitting device 32 by the side of the 4th display 25 is larger than the current which flows to the light emitting device by the side of the 1st - the 3rd display 21-22-24, it makes controllable the display stage in the 4th display 25 by infixing a switching circuit 53 in a light emitting device 32 and a serial, and controlling the switching circuit 53 by microcomputer equipment 37.
[0049] Moreover, the cell remaining capacity display action in the 4th display 25 is fundamentally possible for performing [be / it / under / "on" period / of a motor 17 / beginning] at the period of arbitration. If it is especially in the "on" period of a motor 17, the duty as a pilot lamp in which it is shown that the motor 17 is driving is also achieved to coincidence.
[0050] However, although the terminal voltage Ve of a rechargeable battery 36 continues a fall between t2 from the time of day t1 which a motor 17 is driving like drawing 8 (e), terminal voltage Ve returns with a drive halt of a motor 17:
[0051] Then, if it is in this example, as shown in drawing 8 (a) and (b), after starting motorised at time of day t1, a switching circuit 53 is turned off like drawing 8 (d) in the phase which stopped motorised at time of day t2, and the remaining capacity display action in the 4th display 25 is stopped till time of day t3.
[0052] On the other hand, also during the halt period T1 of the remaining capacity display from time of day t2 to t3, continue like drawing 8 (c) and detection actuation of cell remaining capacity is continued. After holding the remaining capacity at the time-of-day t3 time and performing the display corresponding to the held remaining capacity in the 4th display 25 during the period T2 of t4 from time of day t3, the display in the 4th display 25 is suspended.
[0053] For example, as a result of in the case of an electric shaver hair waste's collecting between the outside cutting edge 14 and the inner cutting edge 12 and a load's becoming large, although there is cell capacity of enough, the display of the purport that a cell residue is small is performed, and a user has a possibility of repeating charge. Even if it is in this case, it can check exactly whether cell capacity remains truly by detecting and displaying the remaining capacity after an energization halt to a motor 17.
[0054] In addition, although it is desirable to be set as the necessary minimum, for example, the short time for about 0.2 - 1 second, which can check that cell voltage returns like drawing 8 (e), and can separate and express the condition before and behind a halt of a motor 17 as for the period T1 which suspends a display after a motor halt, it is natural. [of the ability to be set as arbitration]
[0055] For example, in the time amount, if it is when the time amount for 0.2 or less seconds is set up, since the return of cell voltage is inadequate, the return rate of cell voltage is measured, a final return electrical potential difference is calculated from the measured value, and remaining capacity is guessed. Since the display which shows that it is [of the cell residue performed to it and coincidence] under detection has the short setup time, the thing of the format which it is easy a format to suspend a display simply or to change a color etc., and is easy to recognize is adopted.
[0056] Conversely, when the halt periods of a display are the long times above for 1 second, while the drive of a motor 17 stops completely by performing the warning sign according that cell remaining capacity is detecting during the period to flashing of a light emitting device 32, modification of the luminescent color, or an alphabetic character, it can be made to recognize more exactly to an operator that detection actuation of a charge residue is performed normally.
[0057] In this case, the display performed during the residue display halt period which can be set is possible also for establishing a display means independently, and can also be performed using the 4th display 25. It enables it to check the change situation of the contents of a display by making the contents of a display under the drive of a motor 17, and immediately after a drive halt into a deactivate indication, if it or before is a flashing display, and in short, changing [change / into a flashing display / if it is a lighting display]. If the duty is achieved, a proper change of a display means, the method of presentation, and the contents of a display is made,

and, of course, they can be carried out.

[0058] Furthermore, the display in the 4th display 25 is replaced with turning on or blinking one light emitting device as mentioned above again, luminescence reinforcement is fluctuated, or it can have two or more light emitting diodes, it can be made to be able to respond to the change in remaining capacity, and the number of lightings of a light emitting device can be fluctuated. Moreover, the method of presentation can change suitably replacing with the increase and decrease of a display of the number of lightings by light emitting diode, using other display means, such as a liquid crystal display panel and an EL element, shaving remaining capacity further, and expressing as a numeric value like the count of possible etc.

[0059] However, even if shown in which the above-mentioned method of presentation, it is the same as that of the case where it describes above, immediately after energization stopping to a motor 17.

[0060] In addition, it is also possible to display the remaining capacity which saved the remaining capacity in front of off actuation of a main switch 19, and was saved during the after [a halt] display period T2 performed in the display halt period T1. In this case, the deactivate indication period T1 can be set up short, and a residue display can be resumed immediately after OFF.

[0061] As the concrete configuration is shown in drawing 9 , the motor control section 40 the rotational speed of a motor 17 by push actuation of the subswitch 23 Next, for example, the high speed of per minute 8800 rotation extent, It adds to the "manual mode" which can be changed into the three-stage used as the medium speed of per minute 8300 rotation extent, and the low speed of per minute 7800 rotation extent. Change of the load load which joins a motor 17 is detected, and the three-stage in manual which was made to correspond to the change of load, and described the rotational speed of a motor 17 above is equipped with the "automatic mode" whose automatic modification is enabled.

[0062] Actuation which detects the magnitude of a load using the magnitude of a motor current fluctuating the motor 17 used here corresponding to the magnitude of the load load which joins the inner cutting edge 12 when applied voltage is fixed while the rotational speed is decided by magnitude of the average electrical potential difference which is the thing of direct current system which carries out the rotation drive of the inner cutting edge 12, and is impressed to a motor 17 is performed.

[0063] Then, although modification of the rotational speed of a motor 17 impresses the electrical potential difference of the condition near always or it to a motor 17 like drawing 10 (a) at the time of high-speed rotation By decreasing the rate of the electrical-potential-difference impression time amount occupied in 1 period one by one, as shown in drawing 10 (b) and (c), the average electrical potential difference impressed to a motor 17 was reduced, and the configuration which makes motor rotational speed go up and down is adopted.

[0064] Detection of the load load which joins a motor 17 on the other hand is performed by taking out the electrical potential difference which infixes the low resistance 54 in a motor 17 and a serial, and is fluctuated in proportion to a motor current. Furthermore, the input of drawing 11 (a) and the detection electrical potential difference Vf as shown in (b) is enabled at microcomputer equipment 37 by integrating an integrating circuit 55 with the electrical potential difference generated to the both ends of the low resistance 54.

[0065] Furthermore, three comparison electrical-potential-difference VH-VM-VL which pressured partially the reference voltage VS outputted from a voltage stabilizer 41 in the magnitude of this detection electrical potential difference Vf by resistance is compared with the magnitude of those, and the magnitude of the load which has joined the motor 17 is judged to a three-stage by judging both size relation.

[0066] If it is at the time of a high speed with the idle period of the electrical potential difference to which the time constant in an integrating circuit 55 is impressed by the motor 17 short if it is in this example here, and medium-speed rotation, it sets up so that it may become the large wave of the ripple which repeats charge and discharge like drawing 11 R> 1 (b) at the time of the long low r.p.m. operation of an idle period while setting up like which changes smooth into a condition with few ripples like drawing 11 (a).

[0067] In addition to it, it separates into the 1st comparison electrical-potential-difference

generating circuit 56 for inside high speeds, and the 2nd comparison electrical-potential-difference generating circuit 57 for low speeds, the comparison electrical potential difference which pressures a voltage stabilizer 41 partially and is formed is prepared two kinds, and a setup and judgment actuation of a comparison electrical potential difference can be made to do it by criteria which are different in both.

[0068] That is, if the motor-load detection at the time of an inside high speed is the same loaded condition, since there is little level variation of the detection electrical potential difference Vf accompanying the passage of time, it will set up comparison electrical-potential-difference VH-VM of two kinds of height like drawing 11 (a) which pressured the voltage stabilizer 41 partially and was formed, and will detect the size of a load due to the vertical comparison electrical potential difference and detection electrical potential difference Vf. For example, when the detection electrical potential difference Vf is higher than VH, it is judged as a heavy load condition, high-speed rotation is judged to be inside loaded condition when it is between VM and VH, and control which judges medium-speed rotation to be low loaded condition, and moves from it to low-speed rotation when less than VM is performed.

[0069] On the other hand, if there is a motor 17 at the time of low-speed rotation, even if it is the same loaded condition, the detection electrical potential difference Vf changes a lot like drawing 11 (b). Then, if a peak location exceeds a comparison electrical potential difference VL as a continuous line shows although it is judged as a light load and low-speed rotation is maintained while pressuring reference voltage VS partially, setting up the comparison electrical potential difference VL as only for low speeds and the peak level of the detection electrical potential difference Vf being less than this comparison electrical potential difference VL like the alternate long and short dash line, the control which judges it as what became an inside load or heavy loading, and shifts from low-speed rotation to medium-speed rotation will be performed.

[0070] In addition, although it falls gradually after remaining capacity starts the drive of a motor 17 enough in a certain case, and the rotational speed of a motor falls, if the terminal voltage Ve of a rechargeable battery 36 stops a drive, the electrical-potential-difference value will return. Then, if it is in this example, and it becomes after [of drive initiation of a motor 17] 1 minute, 2 minutes, and 3 minutes, amendment of rotational speed based on the fall of cell voltage Ve will be performed by making the ON time amount Ta in the 1st switching circuit 58 increase gradually.

[0071] However, when cell remaining capacity is less than the set point, the amount of voltage drops at the time of motorised is larger than the case where it describes above, and there are few amounts of returns conversely. then, the dynamic amendment by said increment in the ON time amount Ta of the 1st switching circuit 58 carried out if it is in this case -- in addition, the fall of the motor rotational speed resulting from the terminal voltage Ve of a rechargeable battery 36 falling is amended by adding the steady amendment which decreases "off" period Tb.

[0072] In addition, if it is at the time of the alternating current drive which used the charge adapter 26, the electrical potential difference impressed to a motor 36 is more highly [than the time of the drive only by the rechargeable battery 36] stable. Therefore, amendment actuation is not performed while making the off time amount Tb of the 1st switching circuit 58 increase from the case of the above-mentioned cell drive in this case.

[0073] In order to make the above control action perform, the motor control section 40 While connecting the 1st switching circuit 58 to a motor 17 and a serial Push actuation of a main switch 19 is interlocked with, and removal of the 2nd switching circuit 59 to turn on and the outside cutting-edge holder 15 is interlocked with. By taking out the terminal voltage Ve of a rechargeable battery 36 through the normally closed switch 64 switch off, and inputting into the control edge of the 1st switching circuit 58 as an ON signal, the 1st switching circuit 58 is turned on and will be in the condition that cell voltage can be impressed to the both ends of a motor 17.

[0074] When the wave shown in drawing 10 should reverse the driving signal Sk impressed to the control edge of the 3rd switching circuit 60 from microcomputer equipment 37 in this condition The ON signal which turns on the 3rd switching circuit 60 corresponding to the period of "H" level of a driving signal Sk, and is impressed to the control edge of the 1st switching circuit 58 is made to short-circuit and turn off. A motor 17 rotates at the rate corresponding to

the merits and demerits of the ON time amount Ta of the 1st switching circuit 58 in 1 period.
[0075] Change of the three-stage of this motor rotational speed is displayed by changing the lighting location in three light emitting device 20a, 20b, and 20c with which the 1st display 21 was equipped. That is, under medium-speed operation distinguishes by lighting of light emitting device 20b of the mid-position, under low r.p.m. operation distinguishes by lighting of light emitting device 20c of the lowest location further, and under high-speed operation is displayed by lighting of light emitting device 20a of the best location. Moreover, under lighting of the 2nd display 22 distinguishes automatic mode during putting out lights by setting up beforehand with what displays a manual mode, and modification of a manual mode and automatic mode is displayed.
[0076] As mentioned above, while being able to perform change actuation in the mode exactly by making them approach a lengthwise direction and arranging in a single tier, while equipping further with the subswitch 23 for a mode change the light emitting device 20c bottom for a low-speed display in the 1st display 21 which displays the rotational speed of a motor 17 gradually under it for the 2nd display 22 turned on at the time of automatic mode, actuation and a control state can display clearly.
[0077] In addition, the rotational-speed display in the 1st display 21 is replaced with making only the light emitting device 20 corresponding to the present rotational speed turn on independently as mentioned above, is made to respond to a rate rising, can make the number of lightings able to fluctuate, or only the setup time continues, and it can switch on the light or flashing display a front lighting location, and can also give the after-image effectiveness.
[0078] By performing this after-image display, the rotational speed in front of predetermined time can be checked, and transition of rate change can enjoy itself through vision. If it is especially during shaving, even if there is a rapid rate change by estranging the outside cutting edge 14 from a skin, for example, as a result of displaying the rotational speed under last shaving as an after-image using lighting of three light emitting devices 20 in the 1st display 21, it shaves and middle decision of remnants is attained.
[0079] Moreover, the guess of the judgment of whether it shaves and there are any remnants at the time of a motorised halt is attained from the contents of a display of the 1st display 21 by making the after-image display which described above only the predetermined time after a motorised halt maintain. For example, if the high-speed condition was displayed as an after-image during shaving or shaving was completed in the state of the high speed, it will shave and it will be judged that there are many remnants parts.
[0080] Based on the explanatory view of the change condition of the rotational speed shown in the mode changes Fig. shown below at drawing 12 , and drawing 13 -15, the overall operations sequence of an electric shaver 10 is further explained to a detail focusing on the operations sequence in the motor control section 40.
[0081] It changed the actuation in microcomputer equipment 37 into the power-saving condition, and has controlled the power consumption in a rechargeable battery 36 to the minimum while it suspends all displays, if an electric shaver 10 is in the standby mode which did not charge and suspended the motor 17.
[0082] Here, if only a short time carries out push actuation of the main switch 19 into a standby mode, while going into DC mode driven only with a rechargeable battery 36, starting the energization to a motor 17 and carrying out the rotation drive of the motor 17, the display in the 1st corresponding to the drive condition - the 4th display 21-22-24-25 is performed.
[0083] And shortly after only a short time carries out push actuation of the main switch 19 once again while a motor 17 drives, the energization to a motor 17 stops. The display in a display the display once like drawing 8 (d) however, for example, by stopping, after stopping only a short time for about 0.2 seconds and maintaining only a short time for about 3 seconds anew, for example After indicating that the drive of a motor 17 was completed and detection actuation was ensured, an indication corresponding to the contents of detection is given, and current operating state is made to recognize certainly to an operator.
[0084] If the charge adapter 26 is connected into the above-mentioned DC mode, in addition to a rechargeable battery 36, it will go into AC mode accompanied by electric supply by the charge adapter 26, and if the charge adapter 26 is removed, it will return to DC mode.

[0085] Moreover, if the charge adapter 26 is connected into a standby mode, it will go into charge mode. If it is in this mode, while capacity detection under charge is performed, a charge stage display is performed [be / it / under / charge / correspondence] in the 3rd display 24. When it is detected that charge was completed, while charge is turned off automatically, it indicates that the 3rd display 24 suspended the display during charge, and charge completed it. It moves to AC mode described above when push actuation of the main switch 19 was carried out into this charge mode, and if push actuation of the main switch 19 is carried out once again, it will return to charge mode.

[0086] moreover, when push actuation of the main switch 19 was carried out into the standby mode, it described above -- although it moves to DC mode like and a motor 17 turns on -- further -- about 10 seconds -- if time amount continuation is carried out and push actuation of a main switch 19 is continued, it will go into DEMOMODO. If it is in this DEMOMODO, while stopping the drive of a motor 17, the demonstration display which displays the difference in the contents of a display in the 4th display 25, for example is performed.

[0087] In addition, the contents of a display and the method of presentation in the above-mentioned display are an example, and can carry out a display action which hair waste collected and is different corresponding to the various contents of detection, such as condition and a display corresponding to extent of the memory effect of a rechargeable battery 36. Moreover, modification of the method of presentation, such as replacing with indicating the light emitting device by flashing, and changing the luminescence reinforcement and the luminescent color of a light emitting device, is possible. Furthermore, the difference in the mode used can be more exactly recognized by using the pronunciation means of a buzzer or others and carrying out in addition to the display to the vision which described the display above with sound.

[0088] If the subswitch 23 is turned on during activation in DC mode or AC mode here, whenever it carries out switch actuation once, a motor 17 will repeat automatic mode, a high-speed rotation drive, a medium-speed rotation drive, and a low-speed rotation drive in order. Since the low-speed drive condition by no-load running is common just before changing to a manual mode from automatic mode, the change condition can be made to recognize to a user by going into a high-speed operation drive condition clearly by change of a motor sound.

[0089] Moreover, if off actuation of the main switch 19 is carried out in the state of the predetermined selection by the subswitch 23 and it returns to a standby mode, the drive condition in front of off will be memorized, if ON actuation is carried out again, it will return to the drive mode in front of off, and actuation will be resumed. By this configuration, making a favorite rotational frequency selectable, it can be used with the rotational frequency and user-friendliness improves next time also. In addition, when only the inside of motorised accepts the mode change by the subswitch 19, being started in the rotational speed or drive mode which is not expected at the time of next use is prevented beforehand.

[0090] By the way, when the drive mode at the time of ON of a main switch 19 is a manual mode, even if the memorized rate is in medium speed or a low speed, the lack of torque in the early stages of a drive is prevented by impressing the driving signal at the time of a high speed, and carrying out high-speed rotation compulsorily until motor rotation of a 1-second about room is stabilized from the energization initiation to a motor 17, as shown at the time of day t1-t2 of drawing 15 .

[0091] When the mode at the time of drive initiation is automatic mode similarly, even if it is, irrespective of the size of a load, it goes into a high-speed rotation condition first immediately after drive initiation, and it maintains the condition compulsorily the time for about 3 seconds so that it may illustrate at the time of day t1-t2 of drawing 13 and drawing 14 . Then, the display function which shows that control action is performed normally is demonstrated by being able to start motorised and load detection in the stable condition, and always taking the control process further described above by shifting to a medium-speed condition automatically and load detection being made to be performed for the first time in the phase.

[0092] Moreover, by [above-mentioned] making it shift to a medium-speed drive condition compulsorily like, it can be checked with the acoustic sense by change of the sound in the drive system containing a motor 17, and the vision by change of the contents of luminescence in a

display that detection actuation has been started.

[0093] In addition, detection actuation may not be performed in the state of a medium-speed drive, but it may go into a low-speed drive condition with a high-speed drive condition, and detection actuation may be started. For example, where a high-speed condition is maintained, even if a predetermined period passes, it does not drop on medium speed. By forcing actuation of the skin to an outside cutting edge being detected, beginning by a certain approach including the pressure sensor with which the outside cutting edge was equipped, or a photosensor, and enabling the shift to medium speed or a low speed through the roll control by subsequent current detection Since a high-speed condition is surely maintainable until it contacts the skin, it is cancelable un-arranging, such as a motor halt by the lack of initial torque.

[0094] On the other hand, when going into a medium-speed location and starting detection actuation, in case it shifts to a high speed or a low-speed condition by the roll control accompanying the detection actuation, the transit time to both rates is short, and the rate shift can be performed smoothly.

[0095] Next, after carrying out predetermined time continuation of the rotation of medium speed rather than shifting to a high speed or low-speed rotation immediately, he avoids a rapid rate change and is trying not to give an operator insecurity by making it shift to the target rotational speed, if it is when heavy loading is detected at the time of a low-speed drive, or when a light load is detected at the time of high-speed operation.

[0096] however, heavy loading detects at the time of low-speed rotation -- having (time-of-day t5 reference of drawing 13) -- while shifting to medium-speed rotation immediately from low-speed rotation, the medium-speed rotation condition is made to shift to high-speed rotation as much as possible from low-speed rotation by setting it as a short time for about 1 second for a short time

[0097] Contrary to it, even if inside or a light load is detected at the time of high-speed rotation (the time of day t6 of drawing 13 , and time-of-day t11 reference of drawing 14), it does not shift to medium speed immediately. After continuation of a light load was checked by [for about 4 seconds] carrying out time amount progress since the heavy-loading condition was no longer detected for example, it shifted to medium speed, and it is set as the time amount still longer enough than the medium speed in the middle of the shift to a high speed from the low speed which also described the medium speed above for about 4 seconds.

[0098] By such configuration, it has mitigated the burden to **** which originates in a too rapid rate change by existence of a short-time medium speed at the same time it gives an operator a comfortable feeling by making a response quick, since the detection period of heavy loading at the time of low r.p.m. operation has the common case where shaving is started from unloaded condition.

[0099] While preventing beforehand the displeasure of a rate not being stabilized by avoiding the frequent rate [it is common that a high speed or the detection period of the light load at the time of medium-speed rotation has an intense load effect by repeating actuation of making the outside cutting edge 14 estranging from a mustache during shaving, and] change within this period to it, management protection time until it moves to the next actuation is given.

[0100] Furthermore, even if it is when the outside cutting edge 14 is made to estrange from the skin since predetermined time (this example for 4 seconds) continuation of the rotational frequency of medium speed or a high speed is carried out at least, as a result of maintaining the display corresponding to the rotational speed of the inner cutting edge 12 in front of that, i.e., the size of a load, as it is, it shaves and middle decision of remnants is attained.

[0101] Moreover, detection actuation has set incorrect detection as the appearance which is not performed at the lifting and cone sake, for example, the period for about 1 second, immediately after shifting to a low speed from medium speed (time-of-day [of drawing 13] t3 - t4 reference), without stabilizing a detection electrical potential difference. Consequently, to the ability to reach in a short time for about 2 seconds, after becoming low-speed rotation before shifting to high-speed rotation, after starting high-speed rotation before shifting to low-speed rotation, the long duration for about at least 8 seconds is needed.

[0102] Although the drive and load detection by medium speed are started at the time of day t2 of drawing 13 here, when a heavy-loading condition is detected at the time, it shifts to high-

speed operation immediately, without establishing the latency time. on the other hand, an inside load detects during the drive by medium speed -- having (time-of-day t2 reference of drawing 14) -- even if a light load is detected at the time of day t3 of drawing 14 , it does not shift to a low-speed condition immediately, but after checking that maintain the medium-speed condition for 4 more seconds, and the light load condition is continuing, it is made to shift to a low-speed condition, although the drive by medium speed is maintained as it is

[0103] In addition, for 4 seconds, after it replaces with maintaining a high speed or a medium-speed condition for 4 more seconds after above more light loaded condition is detected, and becoming a high speed or medium speed, although the rate condition is compulsorily maintained by the timer, if load detection corresponding to a current rate is not carried out immediately after that, you may constitute so that a rate change may be made immediately. In addition, the rise side of a rate is quick, the modification timing of the maintenance time amount in each rate condition or a rate is changed suitably, and a descent side can carry it out, if slowly controllable.

[0104] Furthermore, if it is when it changes to automatic mode during operation by the manual mode (the time of day t3 of drawing 15 , and t9 reference) Modification of a smooth rotational speed and stable load detection are enabled indicating that drive mode was changed into automatic from hand control by making load detection start from the time (the time of day t4 of drawing 15 , and t10 reference) of passing for 1 more second, after making rotational speed shift to medium speed.

[0105] In addition, high-speed operation is replaced with making [of about 3 seconds] detection actuation start, after making it medium speed, while carrying out predetermined time continuation immediately after the above-mentioned drive initiation of the motor 17 at the time of automatic mode like. For example, you may make it make it shift to inside or a low speed immediately, without making the load detection by the above-mentioned motor current, or the load detection by other means start, and establishing the persistence time for [chisel] 4 seconds in that case at the time of the high-speed rotation 1 second after rotation of a motor 17 is stabilized.

[0106] In this case, the display which shows the beginning of the load detection 1 second after the above-mentioned high-speed drive is started can be performed, and a user can be made to recognize the beginning of detection certainly by indicating by sound with pronunciation means, such as an audible tone, several times with "PIPPITSU", or blinking a light emitting device and indicating by luminescence.

[0107] Moreover, by forming the switch for decision of automatic mode, during automatic mode activation, the drive rate it was sensed from experience that was comfortable is fixed, and it can set up. Moreover, by establishing the learning function of the contents of actuation and making it start from the contents of a drive presumed to be the optimal at the time of a next drive, actuation is automatically started in the optimal mode and user-friendliness improves. In addition, the contents -- last time, the contents of study performed in that case of that presume the elongation condition of the present mustache to be an average load profile initiation at the time of actuation termination from the time amount progress from it, or judge an operator's use inclination and the selection inclination of a rate -- are not limited.

[0108] furthermore, although it constituted so that the average of a motor current might be taken and the size of a load might be judged if it was in the above-mentioned example, it has replaced not only with this but with this detection approach -- it is -- in addition, it is also possible to form the sensor which enables the judgment of contact with the skin and the outside cutting edge 14 like a pressure sensor or a photosensor in the outside cutting edge 14 or its near. In this case, if the darkness at the time of carrying out direct detection of the push pressure, or pushing an outside cutting edge against the skin is detected, it can constitute after it in the appearance to which it changes to the load detection by the above-mentioned load current, and predetermined rotational-speed control is performed.

[0109] Moreover, whether the mustache is actually shaved and whether it is only strongly pushed to a skin can grasp to accuracy more by having in addition to the judgment approach by the load which described above the approach of counting the number of fluctuation of the shape of a pulse of the motor current generated at the time of shaving, and judging loaded

condition.

[0110] Furthermore, it replaces with making a change in the drive mode of a motor 17 the circuit system accompanying push actuation of the subswitch 23 again, and forming a directly selectable slide type or two or more directly selectable pushbutton switches according to an individual etc. changes the approach of mode selection suitably, and can carry out each mode.

[0111] moreover, changing the rotational speed of a motor 17 into a three-stage -- replacing with -- four or more steps -- or it is stepless and can also change. In that case, even if it is, control states of being applied like abbreviation, such as a rise of the above-mentioned motor rotational speed or a downward inclination, are natural. Furthermore, the display in the 1st display 21 is made to correspond to the number of stages of rate change which can be changed similarly, and is changed.

[Translation done.]